Graduate Studies in YOUR Future

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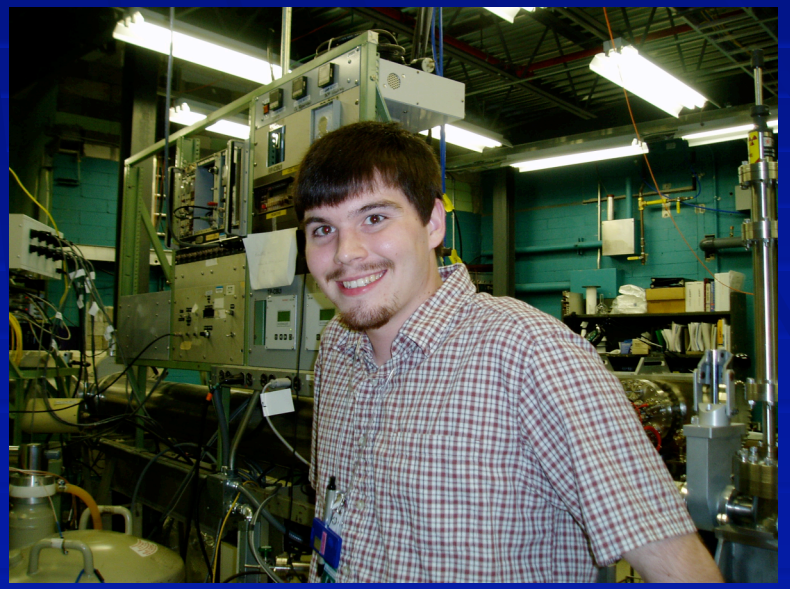
Preparing for Graduate Studies

- Course work
  - Get to know your instructors
  - Do in-depth work, participate in class
  - Maintain good grades



- Research
  - This summer at Brookhaven
  - Other summers?
  - At your home institution?

- GREs w/ Writing Sample
- GRE Subject test (e.g., Chemistry, Physics)

Preparing for Graduate Studies

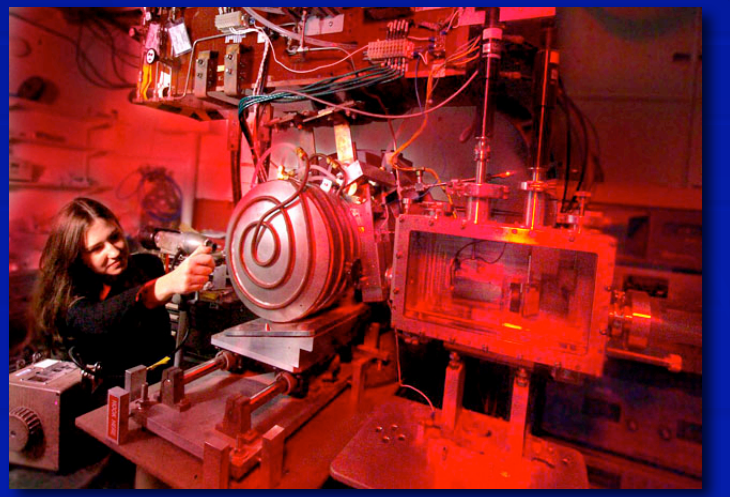
Learn about which school is right for you:

- Suggestions from faculty or research mentors
  - Graduate programs directors at local Univ
- Graduate School recruiting fairs
  - Recruiters at recruiting fairs
- Request written materials and go on-line

- Visit schools before accepting
  - Talk with professors
  - Meet current students
  - Walk around campus, visit the town

Preparing: What to Expect

- Financial support
  - Ph.D. students in chemistry, physics and related fields are supported
  - Make sure indicate that are interested in financial aid (although Ph.D. programs likely to assume so)
  - Apply for external fellowships, too, e.g., NSF Graduate Research Fellowship, or fellowships from DOD or DHS



Preparing: What to Expect

Forms of Financial support (Ph.D. students)

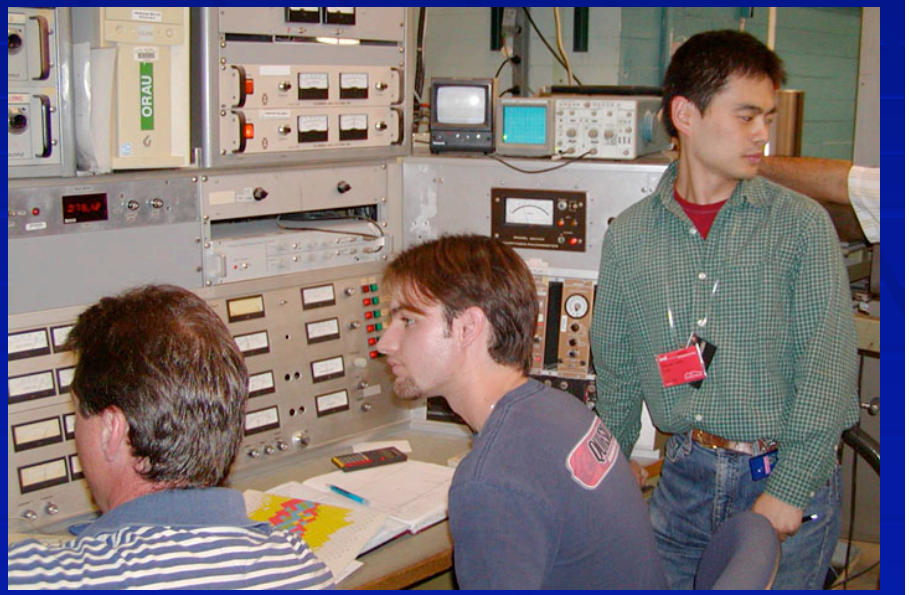
- Stipend + tuition remission (+ medical benefits)
- Teaching assistant or research assistant or fellowship (or combination of these)
  - Teaching Assistant: teach in classroom, often sections of large introductory lecture or lab courses (≈15 hours/week)
  - Research Assistant: Does research on the project of a faculty advisor (not necessarily your dissertation advisor)
  - Fellowship: no work requirements.
    - Award based on excellent promise

Preparing: What to Expect

- What you will do in a PhD program
  - Course work
    - 1-2 years
  - Qualifying exam
    - Sometimes end of 1st,
    - “always” by end of 2nd year
  - <u>Original Research</u>
    - Something no one has ever done before
  - Write, give presentations, often work in teams, often teach
  - 5-6 years in total
    - Make sure are willing to live where you are studying

Preparing: When to apply

- This Summer
  - Do research, start to prepare to take GREs
  - Talk with research mentors about grad study options for you
  - Work on personal statement
- End of junior year/early in senior year
  - Take GREs
    - General, with Writing Sample
    - Subject Test
- Early senior year
  - Decide to which schools will apply
  - Talk to professors about writing letters of reference
- December of senior year
  - Submit applications
- External Fellowships
  - Deadline October of Senior Year



Most programs have deadlines in early January, some in December, especially for financial support

Components of the Application

- Application form: Contact & background info
- Personal Statement
- Letters of Reference
- Transcripts - all colleges you attended
- Lists of relevant courses
- Application fee (≈$50 per school)

Personal Statement

- What you have done
- What you want to do
- Why This School?
- For the specific interests for your graduate studies
- Well written
  - Have friend or mentor critique
  - Spell and grammar check

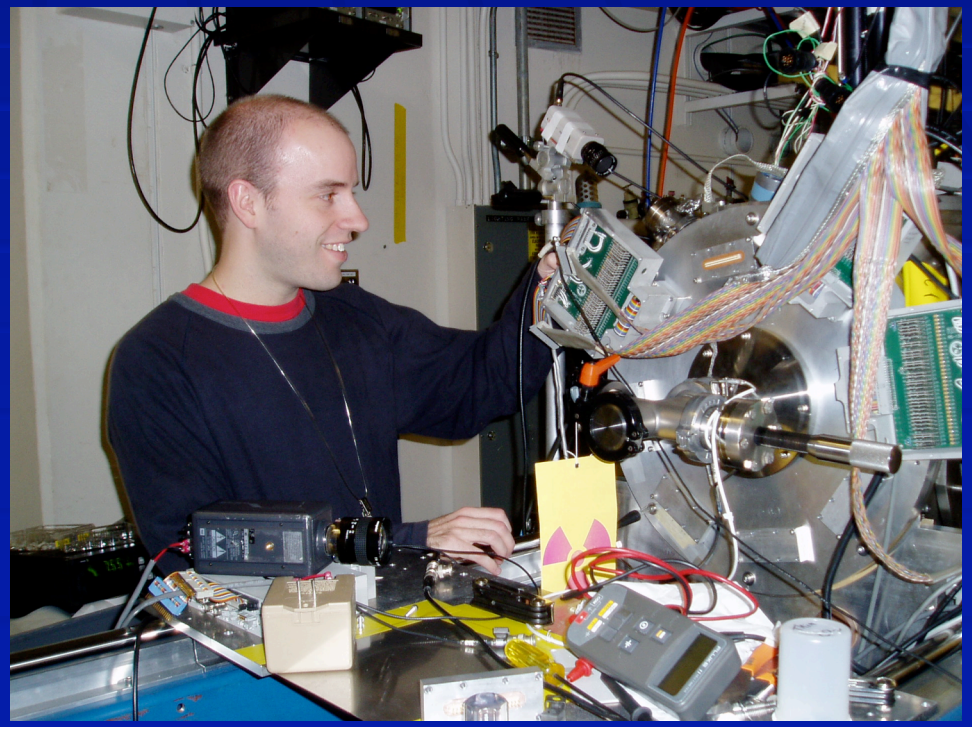
Letters of Reference

- Usually require 3
- People who know you well from
  - Course work
  - Your research

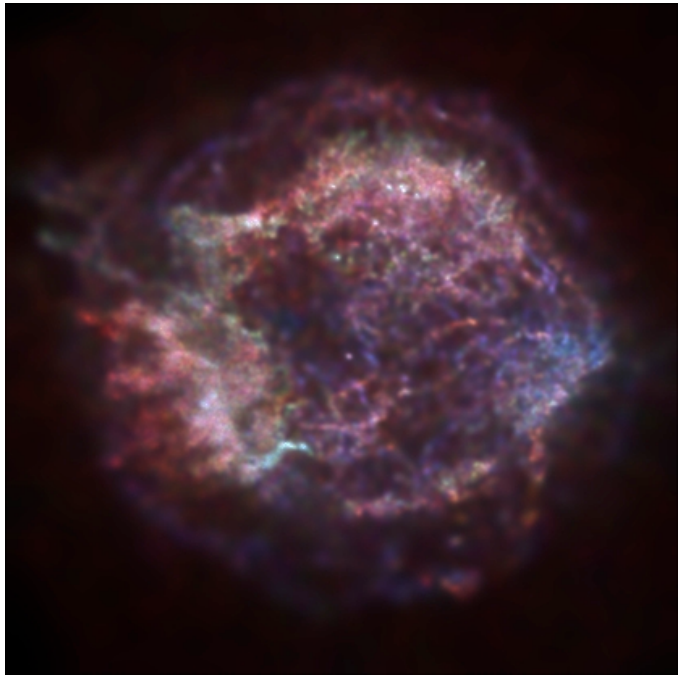
- Examples
  - Supervisor of summer research project(s)
  - Professor in a class where you participated actively in discussions
  - Should be high ranked person AND someone who knows you well
- Someone who will be able to say more than “She got an A in my course”

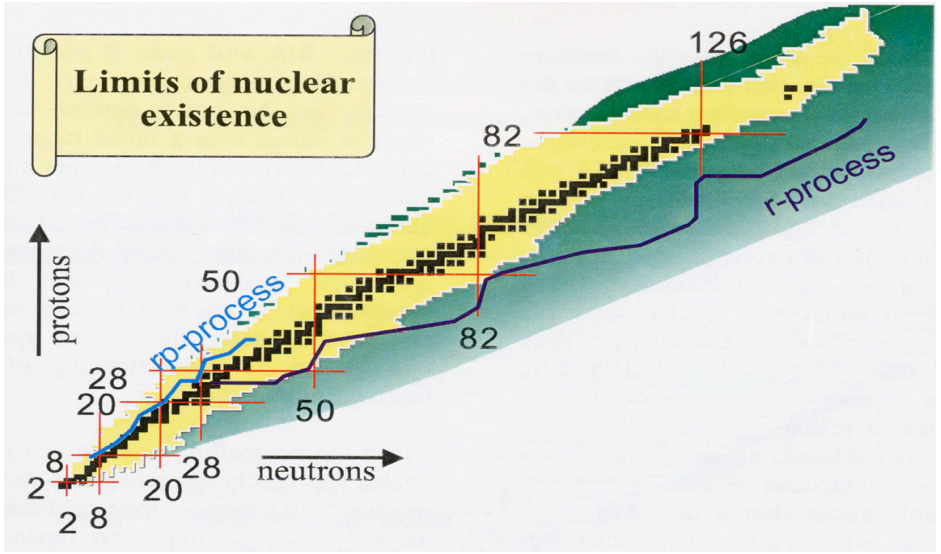
Have fun in Grad School

- In-depth study in a particular field
- Doing something no one has done before
- Preparing for challenging career
- ALL of the above



Fundamental Questions in Nuclear science & Astrophysics





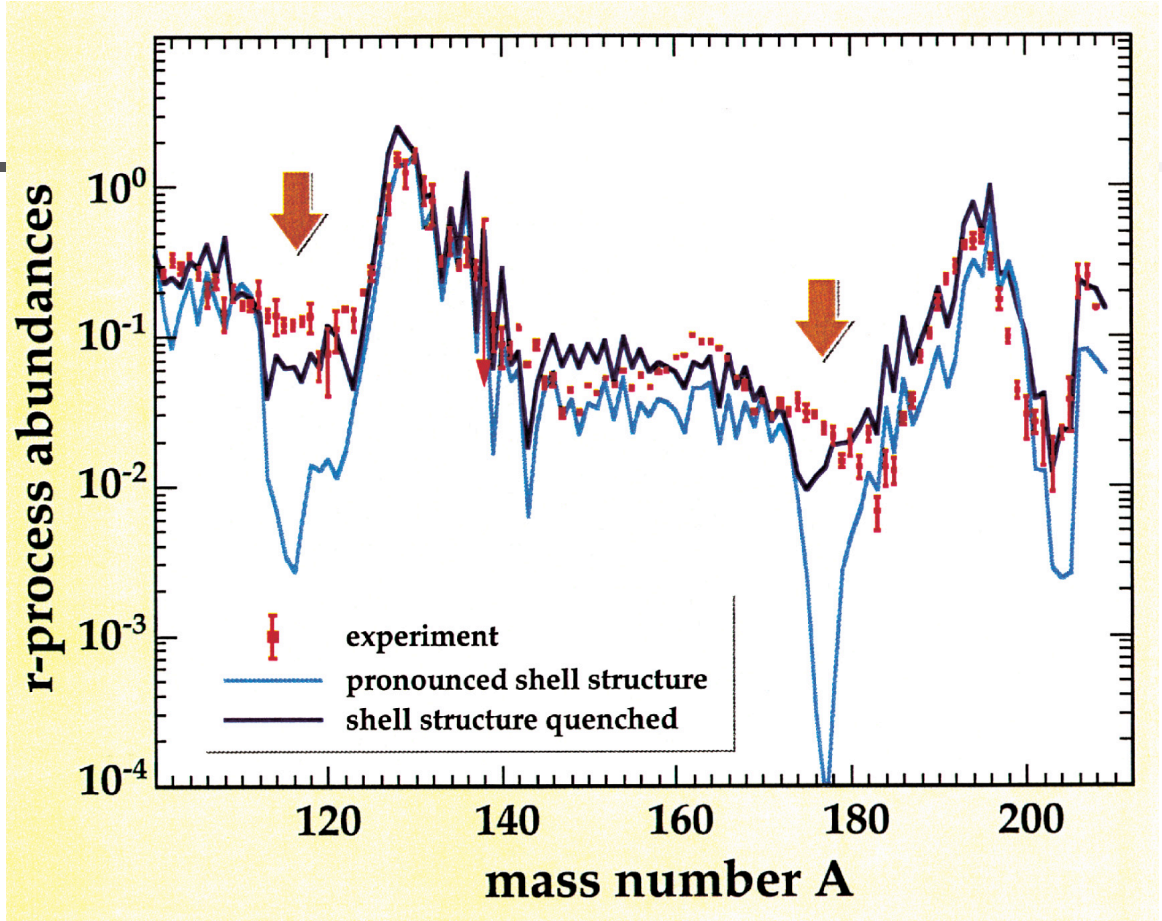
Origin of the elements

Limits of nuclear existence

Synthesis of nuclei at the limits of nuclear stability

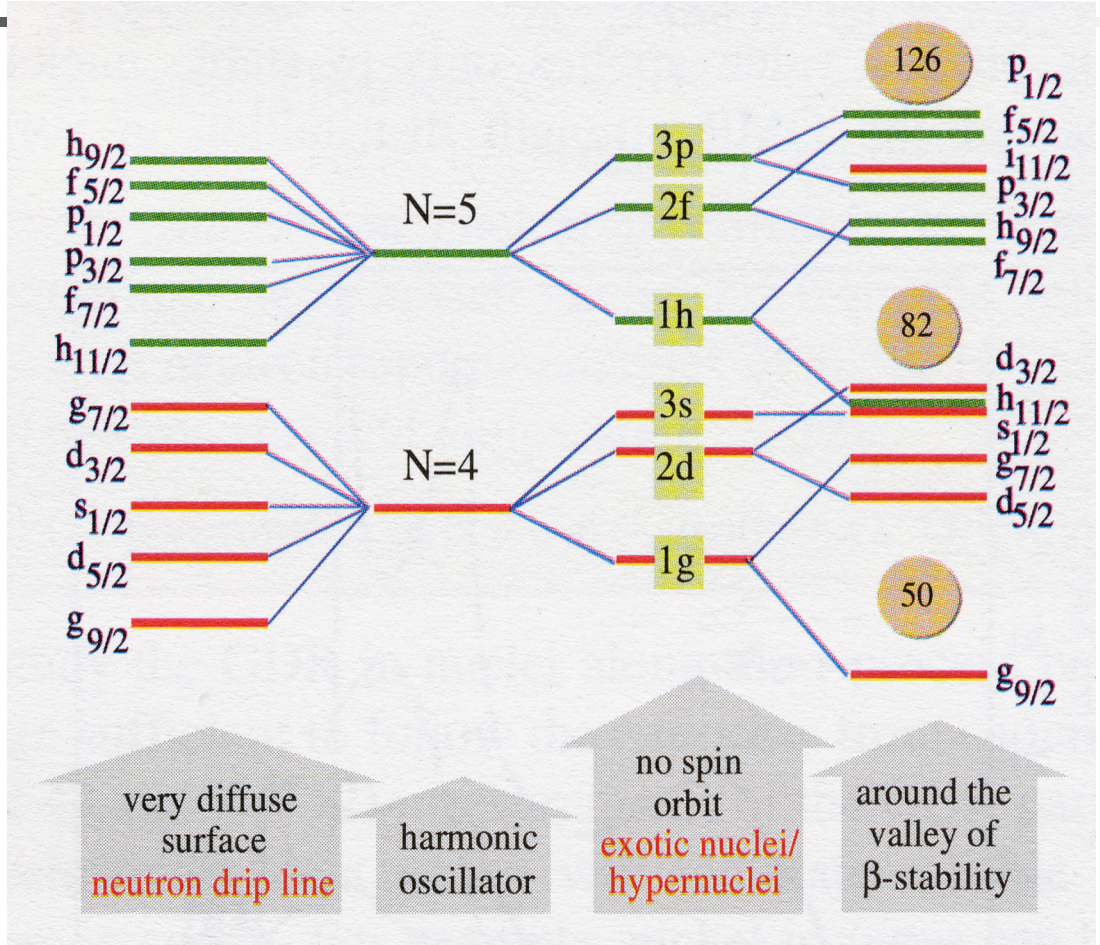
- Understand to occur in explosive events, e.g., supernova explosions
- High flux of neutrons $\Rightarrow$ rapid capture of neutrons $\Rightarrow$ r-process nucleosynthesis
- Sensitive to limits of nuclear stability for very neutron-rich nuclei

r-process abundances



- Peaks of r-process abundances near “magic numbers”, nuclear shell closures
- BUT, models of nuclear structure from stability do not reproduce abundances
- ⇒Change in nuclear structure far from stability

Evolution of nuclear shell structure



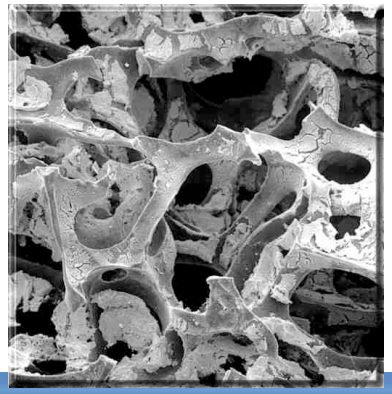
New Nuclear Science Program

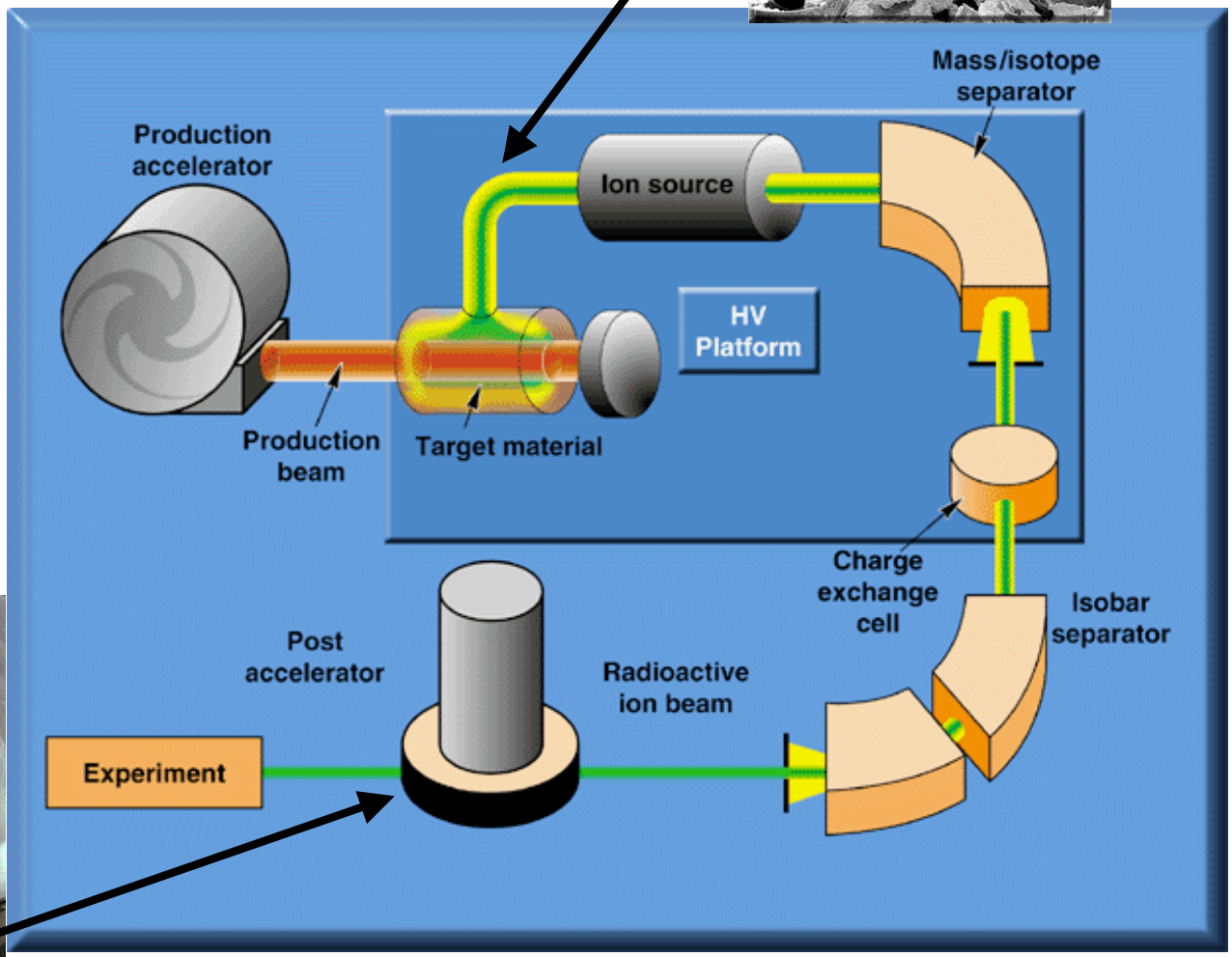
- To measure properties of nuclei far from stability, e.g., along r-process path
- Neutron transfer (d,p) reactions
  - Measure masses and neutron separation energies
  - Measure single-particle energies and properties
- *Beam* is very unstable, neutron-rich species, target is deuterium
- Develop new radioactive ion beams

Measuring (d,p) reaction on unstable species

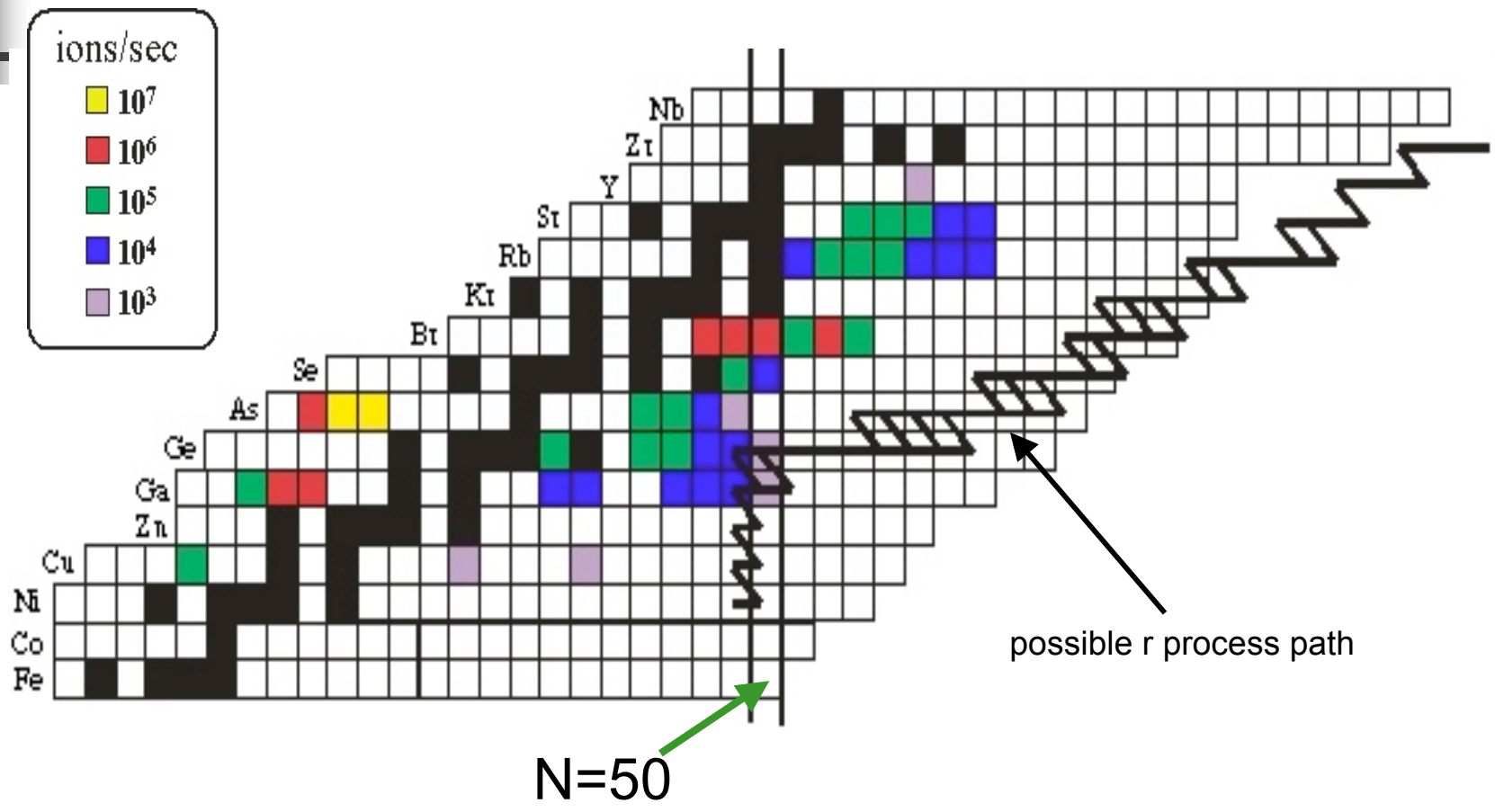
- *Beams* of unstable species rather than stable *targets*
- Can measure beams with $t_{1/2} > 1$ second
- Capability at Oak Ridge National Laboratory
  - Produce unstable beams of ^{238}U fission fragments
  - Use deuterated plastic targets
  - Measure reaction protons
  - Measure beam-like species
  - Develop new radioactive ion beams

Holifield Radioactive Ion Beam Facility





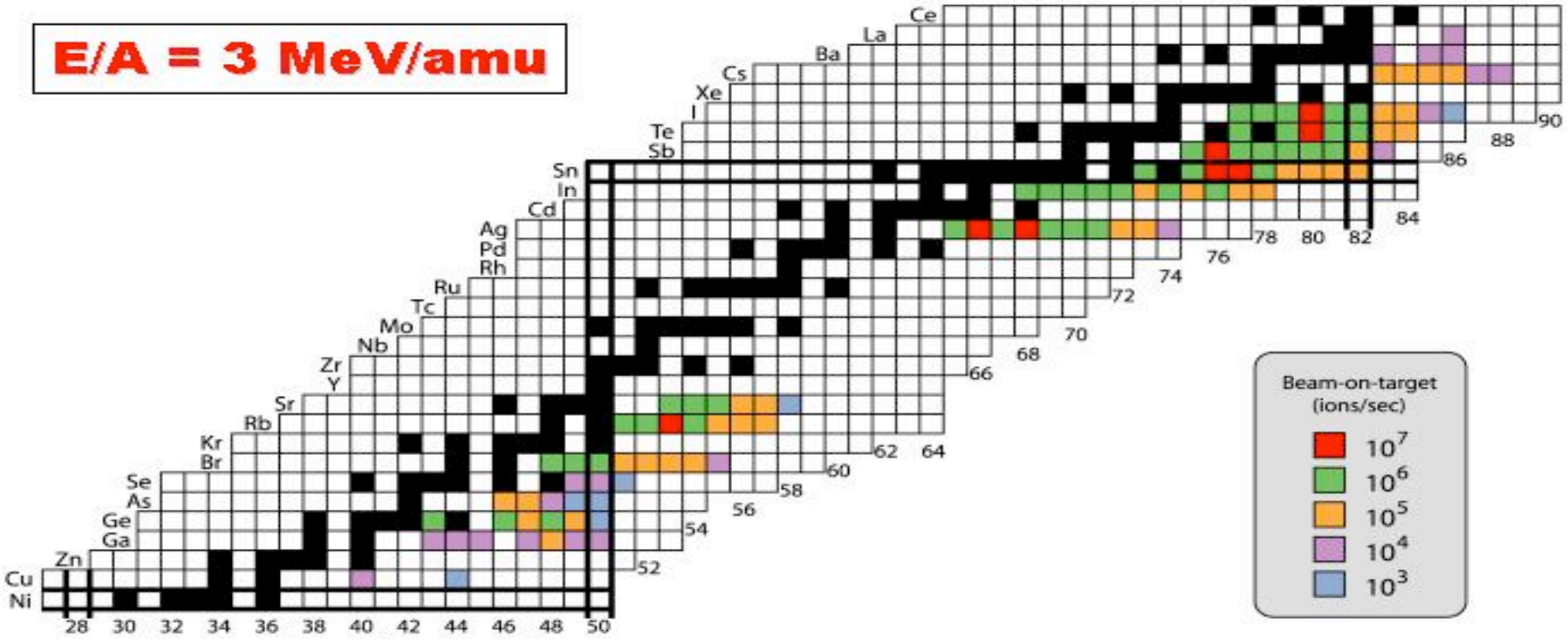
Neutron-rich N≈50 isotones r-process path



Neutron-rich Beams at HRIBF

Accelerated Neutron-rich Radioactive Ion Beams

(over 100 beams with intensities ≥10^3 ions/sec)

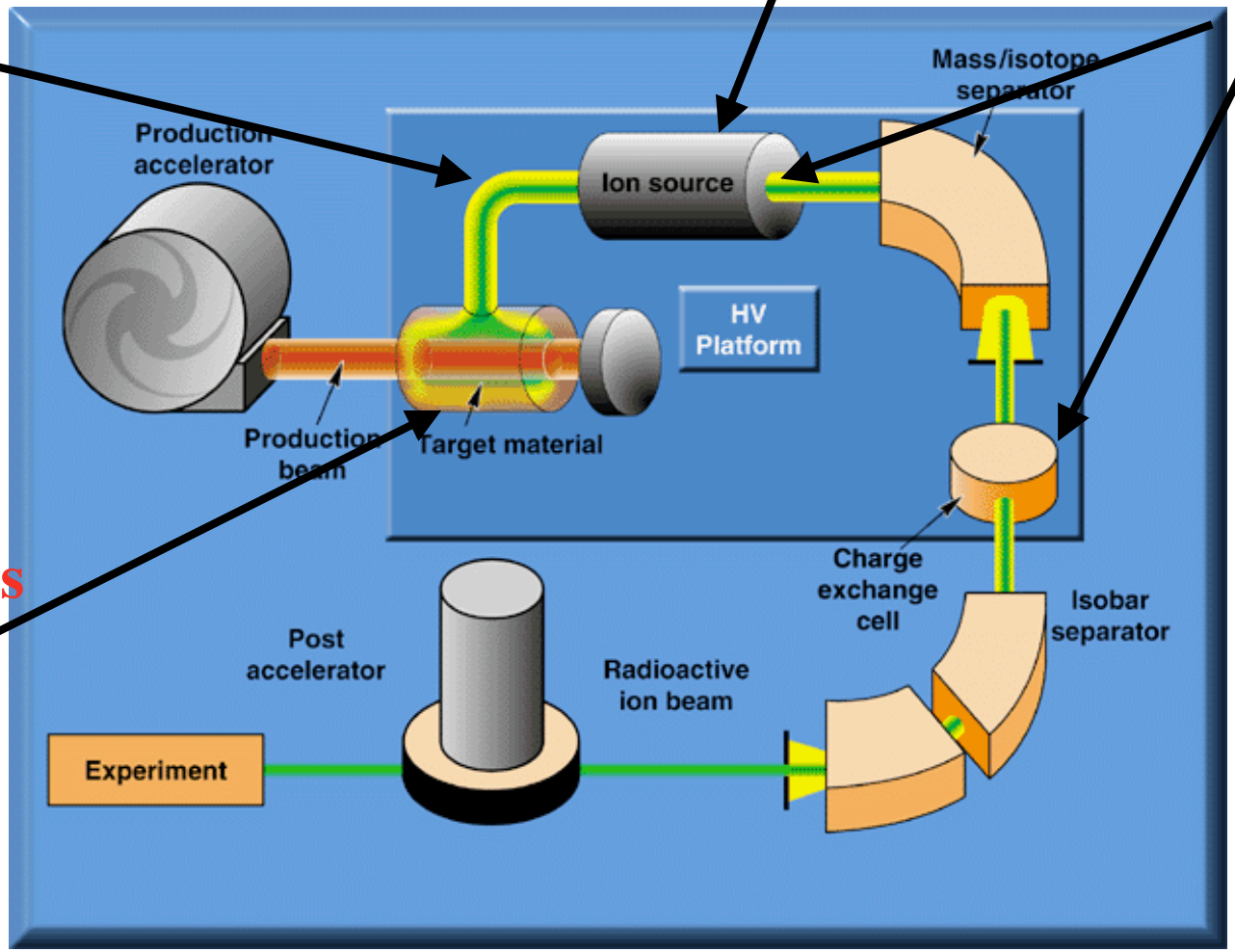


Developing/Improving Unstable Beam Production

3- Ionize atoms

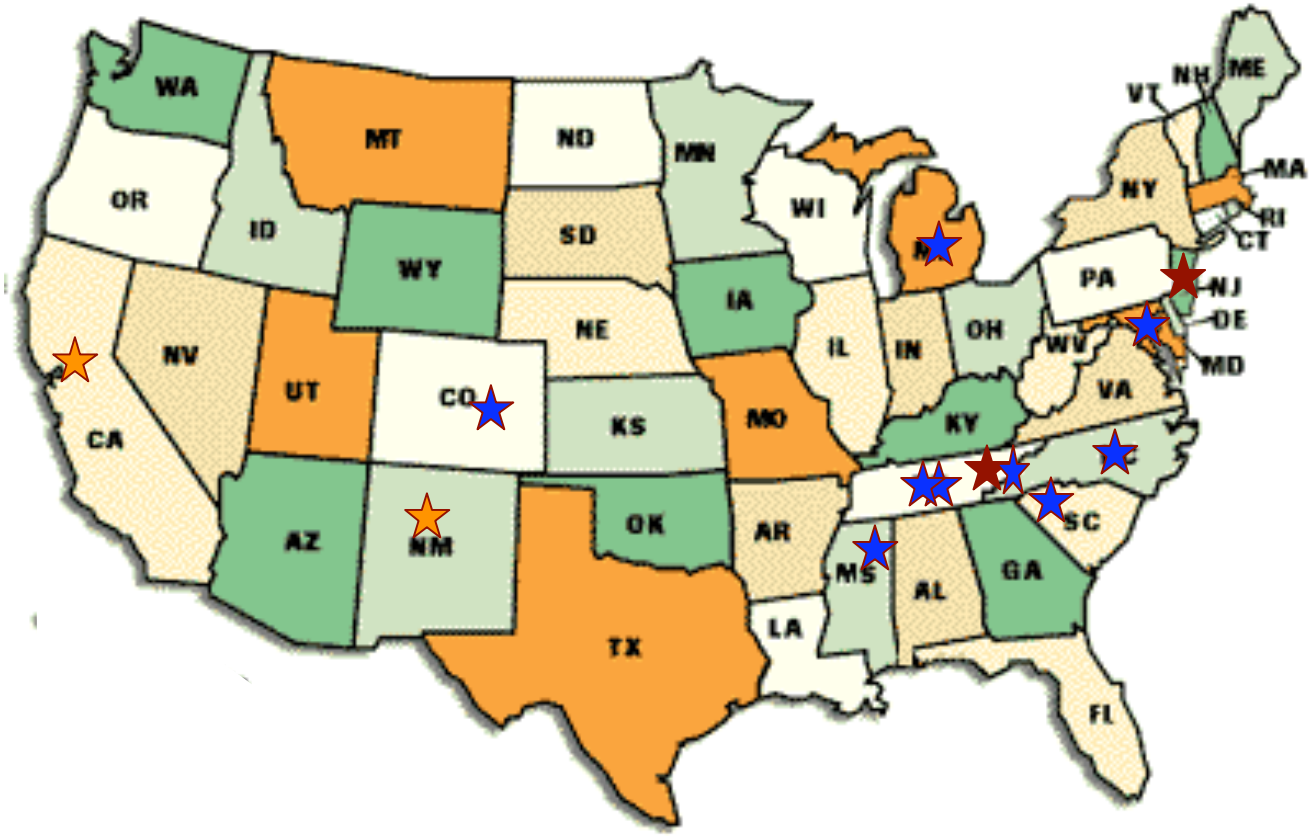
4- Create Negative Ions

2- Transport to ion source



1- Create nucleus of interest

Center of Excellence for Radioactive Ion Beam Studies



PI- ★ Rutgers

Research ★ Oak Ridge

UNIRIB partners

- ★ Tenn Tech
- Univ of TN
- Vanderbilt Univ
- Univ NC-Chapel
- CO School of Mines
- Furman Univ
- MS State
- Univ of MD
- Michigan State Univ

NNSA Partners: ★ LLNL, LANL

Summary

- Graduate School in YOUR Future
  - Prepare now
  - Build on experiences at Nuclear Chemistry School
  - Find best match for YOU
- Consider Rutgers &

Center for Radioactive Ion Beam Studies

  - Chemistry & physics opportunities

Thank you